THIS OPINION WAS NOT WRITTEN FOR PUBLICATION

The opinion in support of the decision being entered today (1) was not written for publication in a law journal and (2) is not binding precedent of the Board.

Paper No. 45

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Ex parte DAISUKI UEDA and HIROMITSU TAKAGI

Appeal No. 94-2080
Application 07/982,068[1]

HEARD: June 13, 1995

Before HARKCOM, Vice-Chief Administrative Patent Judge, JERRY SMITH [2] and LEE, Administrative Patent Judges.

LEE, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal under 35 U.S.C. § 134 from the examiner's final rejection of claims 7-11. 1-6 have been

[1]Application filed November 23, 1992. According to Appellants this application is a continuation of application no. 07/624,519, filed December 7, 1990, which is a continuation of application no. 07/518,328, filed May 5, 1990, which is a continuation of application no. 07/376,374, filed July 5, 1989, which is a divisional of application no. 07/122,603, filed November 18, 1987, which is a continuation of application no. 06/509,055, filed June 29, 1983.

[2]Administrative Patent Judge Raymond Cardillo who sat at the oral hearing has retired and Administrative Patent Judge Jerry Smith has been substituted in his place in this Appeal. See, ***In re Bose***, 772 F.2d 866, 227 USPQ 1 (Fed. Cir. 1985).

canceled. No claim has been allowed.

References relied on by the Examiner

Castrucci et al. (Castrucci)	3,785,886	Jan. 15, 1974
Wickstrom	4,070,690	Jan. 24, 1978
Imaizumi et al. (Imaizumi)	4,278,987	Jul. 14, 1981

The Rejections on Appeal

Claims 7-11 stand finally rejected under 35 U.S.C. § 112, first paragraph, as being without written description in the specification.

Claims 7-11 stand finally rejected under 35 U.S.C. § 103 as being unpatentable over Wickstrom, Imaizumi, and Castrucci.

The Invention

The invention is directed to a vertically oriented insulated gate field effect transistor formed on a semiconductor substrate having a (100) principal plane. A rectangular recess is formed such that at least two side walls thereof make a 45 degree angle against the (01ù) plane of the substrate. Claim 10 appears the broadest and is reproduced below:

10. A power vertical insulated gate FET comprising:

a silicon substrate of high concentration n-type conductivity having a principal (100) plane,

an epitaxially grown lower concentration n-type epitaxial layer on said substrate,

a p-type layer formed on said epitaxially grown n-type layer,

a high concentration n-type top layer formed on said p-type layer,

a rectangular parallelepiped-shaped recess formed in such a direction that its side walls make an angle of 45° against the (Olù) plane of said substrate and in a manner that said side walls are vertical to the (100) plane of said substrate and further in a manner to penetrate to the p-type layer and to reach the epitaxial layer from said top layer,

an oxide film formed in said recess and on said top layer,

an electrode opening formed at a part of said oxide film on said top layer,

a gate electrode formed on a part of said oxide film formed in said recess,

a source electrode of aluminum formed at said electrode opening, and

a drain electrode formed on said substrate.

Independent claims 7 and 11 further specify that first and second sidewalls of the recess are formed along (010) and (001) planes. Claim 7 additionally requires that a high concentration region is formed in at least one of the four corner parts of the rectangular recess. Claims 8 and 9 each depend from claim 7.

Opinion

The rejection for lack
of written description

The appellants evidently represent that there is a mistake in the specification as filed. Specifically, according to the appellants, the plane of the wafer facet 8 in Figure 2A should not be (110) as shown, but (01ù). The (01ù) orientation is nowhere explicitly indicated in the specification as filed, but is recited in the appellants' claims now on appeal. That is the basis of the lack of written description rejection.

In our view, from the perspective of one with ordinary skill in the art a mistake apparently exists, since the wafer surface plane and the wafer facet plane should be perpendicular to each other and yet the (100) and (110) planes are not at right angles to each other. However, because the (100) plane has been described in the prior art as the substrate plane, see Castrucci and Imaizumi, one with ordinary skill in the art would have recognized that the mistake is associated with the (110) designation for the wafer facet plane. Thus, the question is -- what is the correct designation for the wafer facet 8?

In their brief, the appellants explained in two different

ways why the wafer facet plane should be (01ù), based on the (100) orientation of the substrate surface and the (010) and (001) orientations of the rectangular shape cut into the substrate. The examiner, however, evidently concluded that the drawings or diagrams used in the explanations constitute new matter and cannot be considered. The examiner is incorrect. As the appellants correctly point out in their reply brief, the arguments and presentations in the brief are not any portion of the specification but are the arguments and explanations of the appellants as to why the examiner has erred. Accordingly, the explanations must be considered.

Based on the explanations, the appellants have, at the very least, established a prima facie case why the wafer facet plane, based on the orientations given for the various other planes in the original specification, i.e., the substrate plane, and the planes of the side walls of the rectangular recess, is the (01ù) plane, and thus the (01ù) designation only makes explicit what is implicit. The examiner has offered no evidence or valid reasoning to refute the appellants' contentions.

The test for determining compliance with the written

description requirement is whether the disclosure of the application as originally filed reasonably conveys to the artisan that the inventor had possession at that time of the later claimed subject matter, rather than the presence or absence of literal support in the specification for the claim language. Vas-Cath Inc. v. Mahurkar, 935 F.2d 1555, 1563, 19 USPQ2d 1111, 1116 (Fed. Cir. 1991); In re Kaslow, 707 F.2d 1366, 1375, 217 USPQ 1089, 1096 (Fed. Cir. 1983). Satisfaction of the written description requirement does not require the description to be in *ipsis verbis* antecedence in the originally filed application. In re Lukach, 442 F.2d 967, 969, 169 USPQ 795, 796 (CCPA 1971).

For the foregoing reasons, we do not sustain the rejection of claims 7-11 under 35 U.S.C. § 112, first paragraph, as being without written description in the original specification.

The obviousness rejection based on Wickstrom, Imaizumi, and Castrucci

We do not sustain this ground of rejection.

Wickstrom discloses a vertical field effect transistor structure built on the sides of finger-like mesas only the central portion of which is described as being substantially vertical. Also, it does not identify or discuss the orientation

of the finger-like mesas relative to any specific crystal lattice plane, or the orientation of the principal plane. That deficiency is recognized by both the appellants and the examiner.

Castrucci, on the other hand, discloses a conventional non-vertical transistor structure formed with a (100) oriented principal substrate plane. But the appellants are correct that even if the teachings of Wickstrom and Castrucci are reasonably combinable, which we think it is, it only would reasonably have suggested using the (100) crystal plane as the principal plane. The appellants have advanced no reason why the same principal plane orientation used for conventional non-vertical transistor structures may not be used for vertical transistor structures.

Assuming that the principal substrate surface plane is the (100) plane in Wickstrom, there are still many possible orientations for the side walls of the finger-like mesas, not necessarily aligned with the (010) or (001) crystal plane, or with a plane at 45E angle to the (01ù) plane, as is required by the appellants' claims. On this record, the examiner has not presented sufficient evidence that one with ordinary skill in the art would have deemed obvious to orient the finger-like mesas of Wickstrom in a direction such that their side walls are aligned

in the manner as is required by the appellants' claims. While it is true that the finger-like mesas have to be oriented in some direction, but without specific evidence, it cannot simply be assumed that the appellants' claimed orientation either is well known in the art at the time of the invention or otherwise would have been obvious to one with ordinary skill in the art. Additionally, we note that the curved recesses between Wickstrom's finger-like mesas are not exactly the rectangular parallelpiped recesses called for by the appellants' claims.

The examiner's discussion on page 4 of the answer with regard to Imaizumi is not understood and appears erroneous. According to the examiner (p.4, lines 2-4), Imaizumi's Figure 10 illustrates that on a (100) plane surface a rectangular groove 94 can be formed at a 45 degree angle to the <100> direction. Also according to the examiner (p.4, lines 16-20), evidently based also on Figure 10 of Imaizumi, a groove with the desired side walls can be formed on a (100) surface oriented wafer with an anisotropic etch through a rectangular window whose sides make a 45 degree angle with the <110> direction of the substrate wafer. Both positions are misplaced.

Figure 10 of Imaizumi shows two rectangular windows 94 and 95 on a substrate having a surface plane orientation (100). The

first window has side walls rising in the <100> direction of the crystal axis, and the second window 95 has side walls rising in the <110> direction which is at 45 degrees relative to the direction of the side walls of the first window 94. Figure 10 does not illustrate anything specific about (1) the orientations of segments AD and BC, or AB and DC, or (2) the angle between segment AD or BC, and the wafer facet edge, or (3) the specific orientation of the wafer facet edge. See the discussion of Figure 10 in Imaizumi's column 8, lines 49-64.

Other findings of the examiner are also without support and are incorrect. In the answer, on page 4, lines 7-10, it is stated that "due to rotation, the (010) and (001) surfaces may be considered equivalent to the (100) upper surface and may be so designated." It should be noted that these planes are ordinarily perpendicular to each other as is shown in Figure 2B of the appellants' specification, and that is not changed by any amount of rotation of the device as a whole. It is without basis to conclude that these planes are equivalents, especially when the appellants' claims specify different elements to be on different planes. Finally, the examiner has read the appellants' claims as though it recites the (110) plane, rather than the (01ù) plane,

as the plane making a 45 degree angle with a pair of side walls of the rectangular recess. That is inappropriate, since the claims recite the (01ù) plane and not the (110) plane.

In any event we further agree with the appellants that Imaizumi's subject matter is too remote from that of Wickstrom's invention to have a meaningful significance. The rectangular recess formed in Imaizumi is intended to be filled in to form an area of extra thickness, and the objective in Imaizumi is to form an epitaxial layer with a very even top surface but different thicknesses in different parts thereof. It is unclear and has not been well explained by the examiner why it would have been

obvious to one with ordinary skill in the art to use Imaizumi's teachings on the finger-like mesas of Wickstrom.

The initial burden is on the examiner to establish a *prima facie* basis to reject the claims. In re Oetiker, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992); In re Piasecki, 745 F.2d 1468, 1472, 223 USPQ 785, 788 (Fed. Cir. 1984). The examiner must provide an adequate factual basis to support an obviousness conclusion. In re Warner, 379 F.2d 1011, 1016, 154 USPQ 173, 178 (CCPA 1967). Here, the examiner has failed to present a reasonable explanation as to why the evidence

establishes a prima facie case of obviousness. The necessary burden has not been met.

Additionally, with respect to independent claim 7 and claims 8 and 9 which depend from claim 7, these claims require a region of high [dopant] concentration in at least one of the four corner parts of the rectangular recess. In our view, this feature must reasonably be construed so as to require a higher dopant concentration in at least one corner of the recess than that generally in the non-corner areas of the recess. Th examiner stated that in Wickstrom a high concentration N+ region extends to all corners of the groove. However, that does not satisfy the claimed feature as we have construed.

For all of the foregoing reasons, we do not sustain the rejection of claims 7-11 under 35 U.S.C. § 103 as being unpatentable over Wickstrom, Imaizumi, and Castrucci.

Conclusion

The rejection of claims 7-11 under 35 U.S.C. § 112, first paragraph, as being without written description in the specification is reversed.

The rejection of claims 7-11 stand under 35 U.S.C. § 103 as

being unpatentable over Wickstrom, Imaizumi, and Castrucci is reversed.

REVERSED

GARY V. HARKCOM Vice-Chief Administrative Patent Judge	)	
JERRY SMITH Administrative Patent Judge	)	BOARD OF PATENT APPEALS AND INTERFERENCES
JAMESON LEE Administrative Patent Judge	)	

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